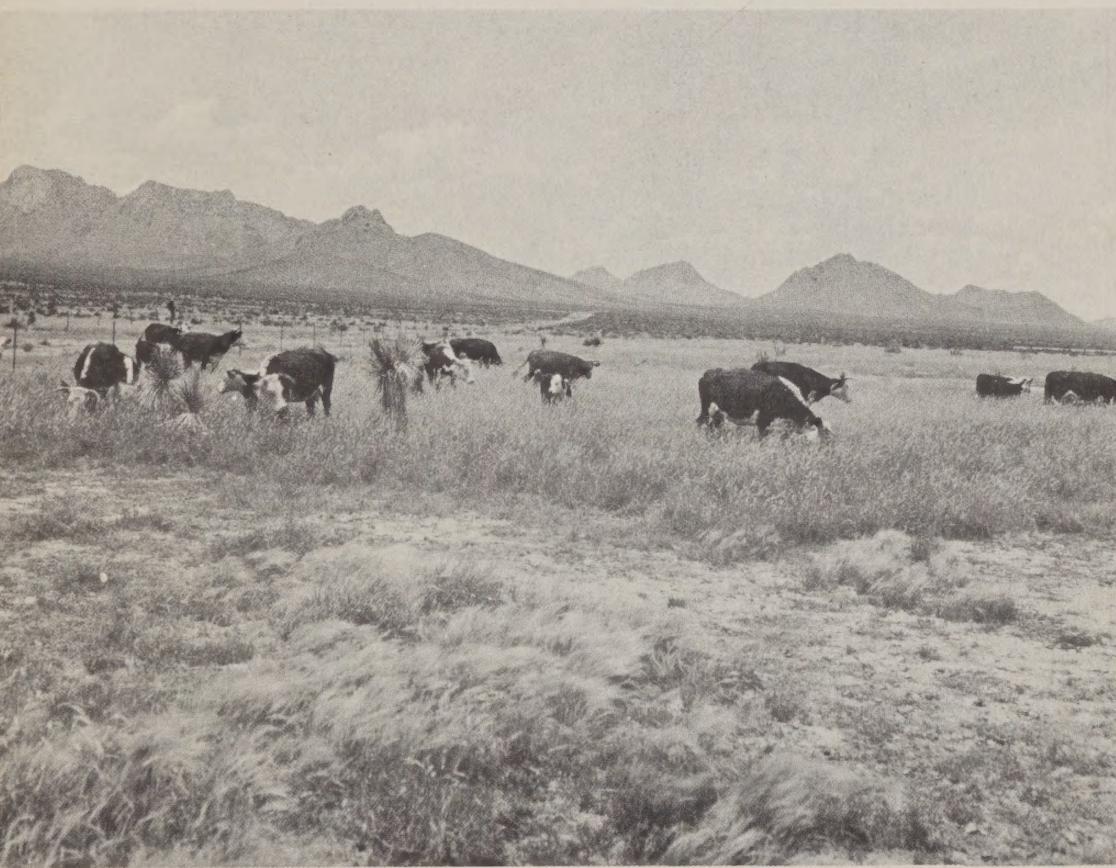


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THE JORNADA EXPERIMENTAL RANGE LAS CRUCES, NEW MEXICO



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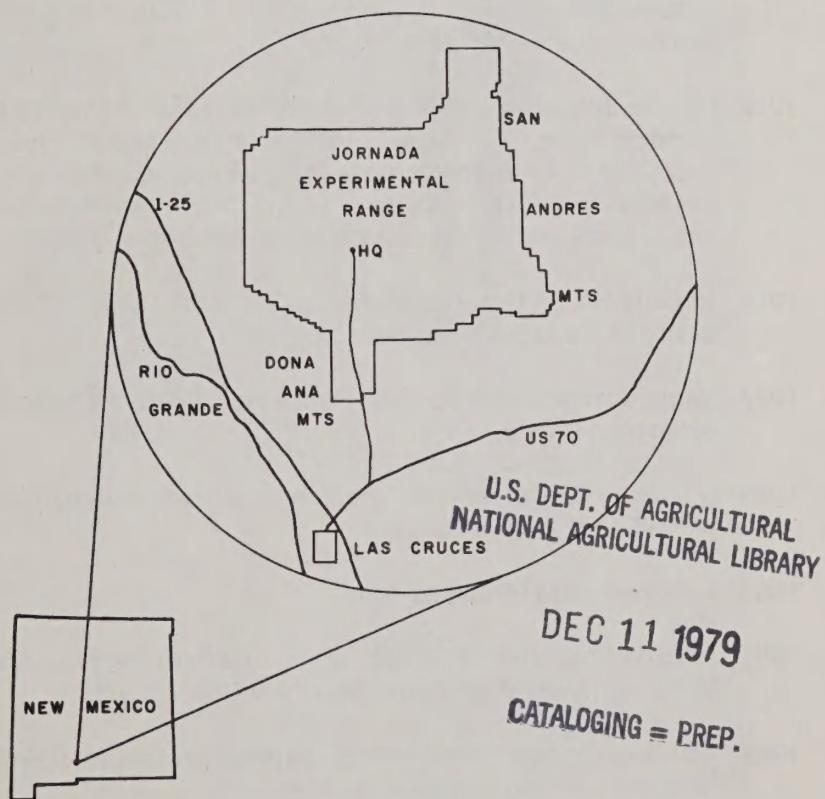
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THE JORNADA EXPERIMENTAL RANGE LAS CRUCES, NEW MEXICO

Location

The Jornada Experimental Range is located 23 miles (37 kilometers) north of Las Cruces, N. Mex. The major portion of the Range is on the Jornada del Muerte Plain, which lies between the Rio Grande Valley on the west and the San Andres Mountains on the east. The crest of the San Andres Mountains roughly coincides with the eastern boundary of the Range.



Historical Highlights

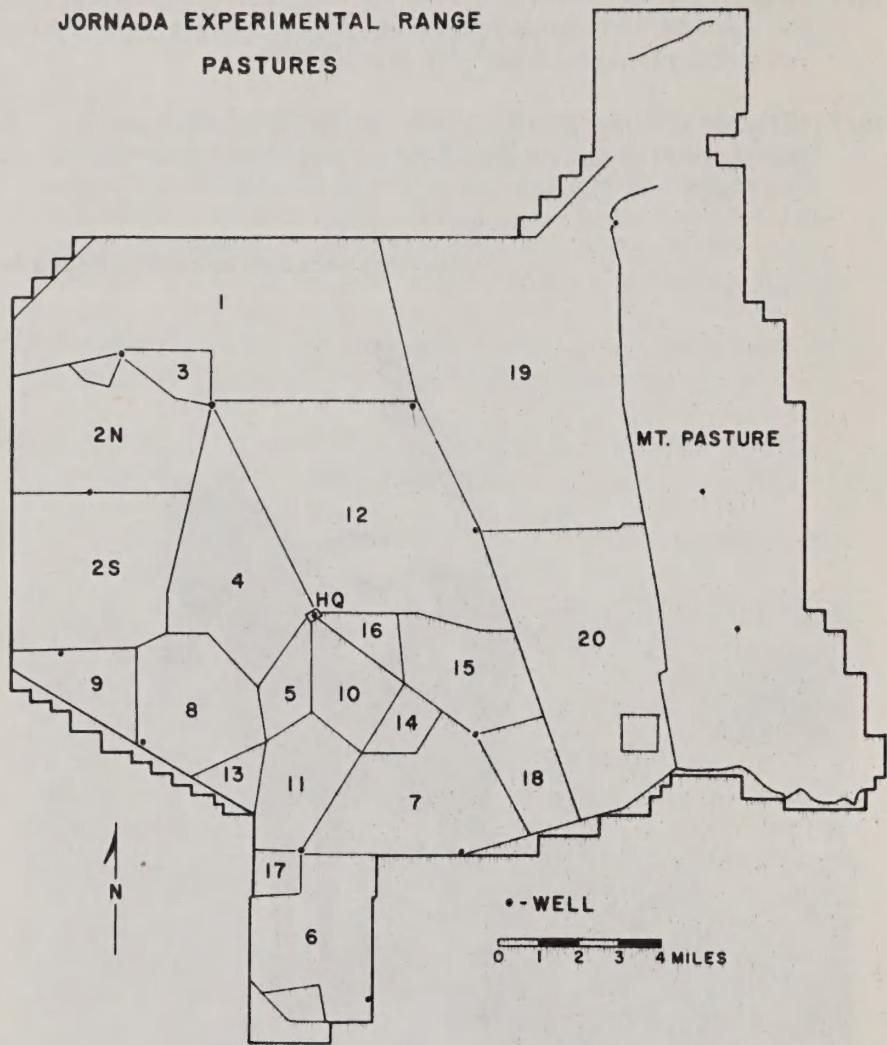
- 1589 Don Juan de Onate followed the Rio Grande northward during his conquest and settlement of New Mexico. In the next three centuries, the Jornada del Muerto (Journey of Death) Plain was traversed by mission supply caravans, the Santa Fe-Chihuahua trade caravans and, finally, stagecoach lines. The former trail is still visible a few miles west of the Jornada Experimental Range.
- 1858 First land survey of the area, which later formed the Jornada Experimental Range, with records made of soils and vegetation.
- 1880 Beginning of decade during which ranches were established at springs in the San Andres Mountains.
- 1901 C. T. Turney, a rancher, settled at site of Jornada Headquarters and gained control of water sources in the area.
- 1904 E. O. Wooton, visionary botanist with the USDA, started cooperative range investigations with C. T. Turney and other ranchers in southern New Mexico.
- 1912 Largely through the efforts of Wooton, the Public Domain lands comprising the C. T. Turney ranch were set aside by Presidential Executive order as the Jornada Range Reserve, administered by the Bureau of Plant Industry in the USDA. Turney remained as the first of a continuing succession of cooperating ranchers.
- 1915 Jornada Range Reserve transferred from the Bureau of Plant Industry to the U.S. Forest Service.
- 1927 Name changed from Jornada Range Reserve to Jornada Experimental Range.
- 1945 U.S. Army leased mountain portion of Jornada as a buffer zone for White Sands Missile Range.
- 1953 Additional area leased by Army.
- 1954 Jornada Experimental Range transferred from the Forest Service to the Agricultural Research Service (ARS).
- 1958 New form of agreement with cooperators started wherein ARS has full control of livestock and facilities.

- 1971 Grazing use reinstated on part of the Army-controlled portion of the Jornada, and research activities, but not grazing, reinstated on remainder of original area.
- 1977 Selected as a Biosphere Reserve by UNESCO's Man and the Biosphere Program. Also, designated as an Ecological Reserve by The Institute of Ecology.

Applying herbicide to control mesquite.



JORNADA EXPERIMENTAL RANGE
PASTURES



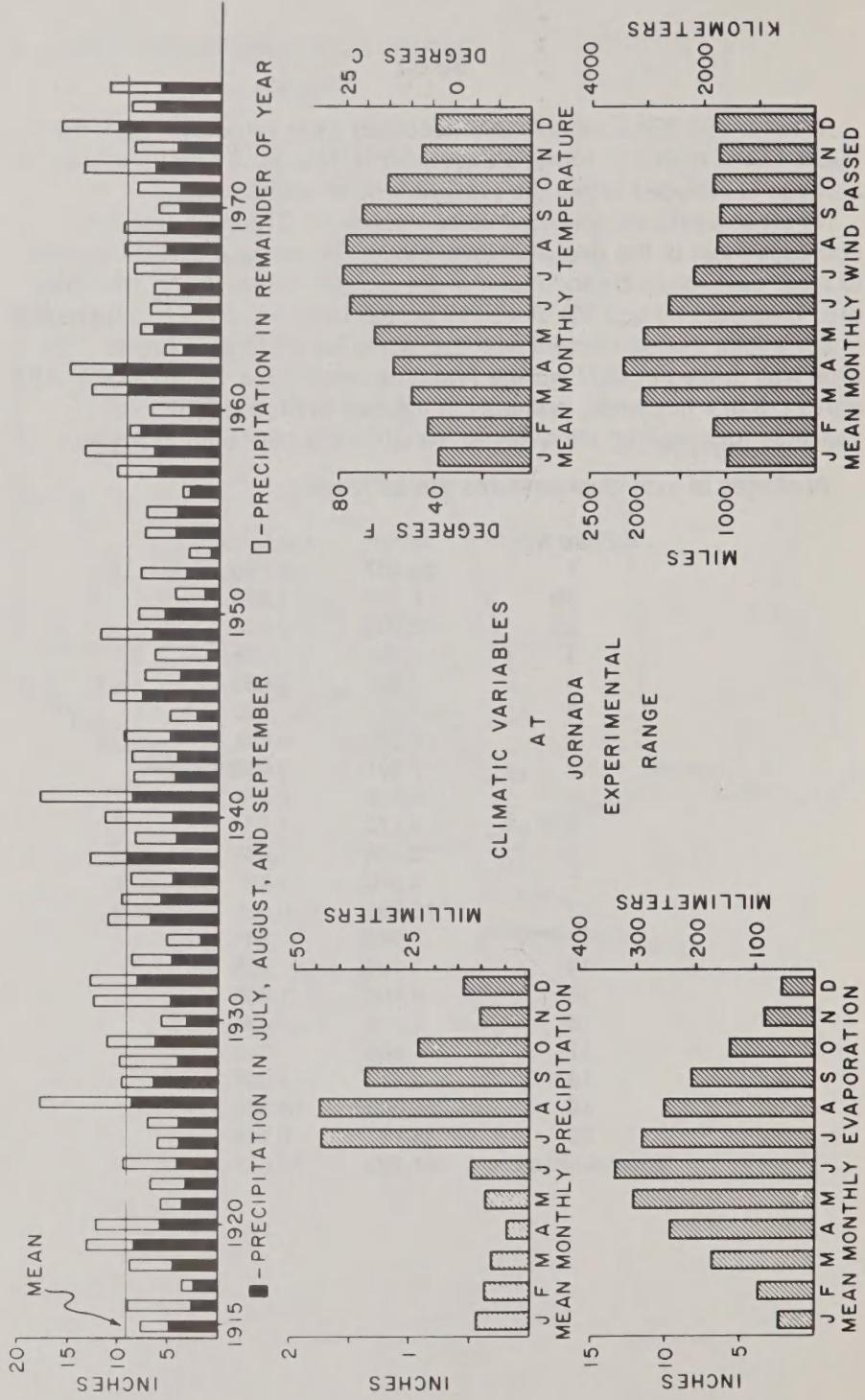
Area

In 1912, 193,394 acres (78,266 hectares) were withdrawn from the Public Domain for the Jornada Experimental Range. A slightly smaller acreage is included within the present fenced boundaries.

Nineteen pastures, totaling 105,688 acres (42,772 hectares), encompass most of the relatively level plains. These pastures are the site of most past research and much of the current research. An additional area (pastures 19 and 20) of 40,717 acres (16,478 hectares) is managed under a joint use agreement with the White Sands Missile Range. This area was grazed in 1971 for the first time since 1953. An area of 41,193 acres (16,671 hectares), primarily in the San Andres Mountains, is available for research although no livestock are permitted at present.

Acreages of individual pastures are as follows:

Pasture No.	Acres	Hectares
1	20,407	8,259
2N	8,204	3,320
2S	8,980	3,634
3	1,281	518
4	7,555	3,058
5	1,780	720
6	6,502	2,631
7	7,501	3,036
8	5,512	2,231
9	3,172	1,284
10	2,638	1,068
11	3,610	1,461
12	16,896	6,838
13	942	381
14	1,198	485
15	4,463	1,806
16	1,072	434
17	856	346
18	2,537	1,027
19	25,600	10,360
20	15,117	6,118
Mountain Pasture	41,193	16,671



Climate

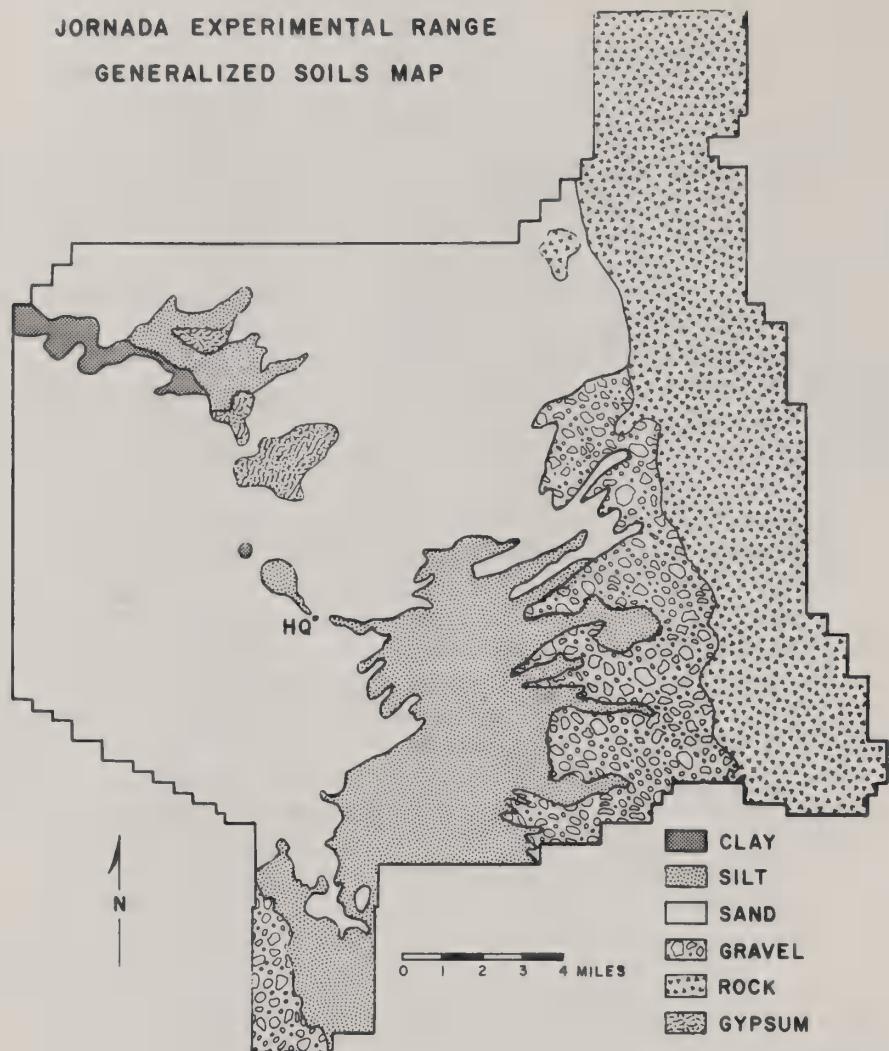
The climate of the Jornada Experimental Range is typical of the semidesert grassland, the most arid of the North American grassland regions. There is an abundance of sunshine, a wide range between day and night temperatures, low relative humidity, and extremely variable precipitation.

There are two precipitation peaks: the summer rains occur primarily in July, August, and September; whereas, winter precipitation occurs from December to February. Winter frontal storms originate over the Pacific Ocean and are characterized by gentle, low-intensity precipitation that covers wide areas and may last for several days. The summer precipitation originates in the Gulf of Mexico and occurs as intense, convective thunderstorms—highly localized and of short duration.

Rainfall records have been kept at the Jornada Experimental Range Headquarters since 1915 and at other locations on the Range for equal or shorter timespans. The average annual precipitation is 9.05 inches (230 mm) with 52 percent of the annual rainfall occurring between July 1 and September 30. Droughts, or periods of low rainfall that seriously injure vegetation, are a recurrent climatic phenomenon. Severe droughts occurred in 1916-18, 1921-26, 1934, and 1951-57. The 1951-57 drought is believed to be the most severe in the past 350 years.

The average maximum temperature is highest in June when it averages 97° F (36° C); the temperature is lowest in January when the average maximum is 56° F (13.3° C). The effective growing season, when both precipitation and temperature are favorable, is normally July through September.

JORNADA EXPERIMENTAL RANGE
GENERALIZED SOILS MAP



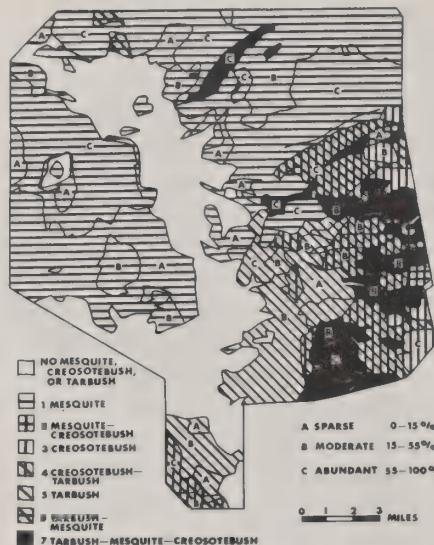
Vegetation

The Jornada Experimental Range is usually classified as semidesert grassland, which covers about 26 million acres (10,526,300 hectares) in southeastern Arizona, southern New Mexico, western Texas, and northern Mexico. Research results are applicable to much larger areas. Although called "grassland," the region contains a complex of vegetation types ranging from pure stands of grass, through savana types with grass interspersed by shrubs or trees, to nearly pure stands of shrubs. The mountains, plains, and drainageways provide a great variety of habitats for plants, and the flora is rich in species. On the Jornada Range, some 545 species of higher plants have been collected.

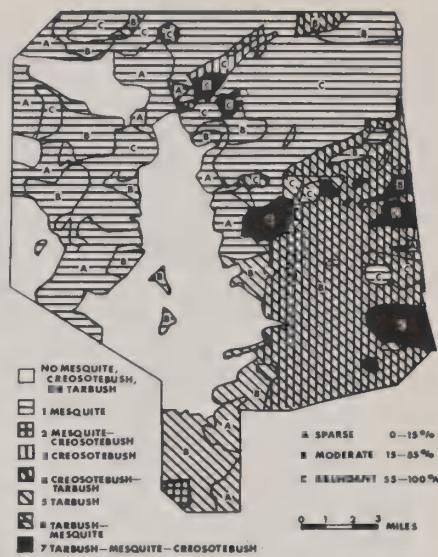
On the Jornada Plain, the major grass species on sandy soils are black grama, mesa dropseed, and red threeawn. Shrubs or shrublike plants on sandy soils include honey mesquite, fourwing saltbush, soap-tree yucca, and broom snakeweed. Extensive dunes have developed where mesquite has invaded sandy soils. Low-lying areas with heavier soils, and which receive water from surface runoff, are dominated by tobosa and burrograss. Tarbush is a frequent invader on heavy soils. The slopes with gravelly soils leading up to the mountains are dominated by creosotebush.

Within the mountains, shrub types are mixed. Major dominants include honey mesquite, creosotebush, sotol, ocotillo, mescat acacia, and mountain mahogany. Some areas of scrub woodland are dominated by oneseed juniper and Mexican pinyon pine.

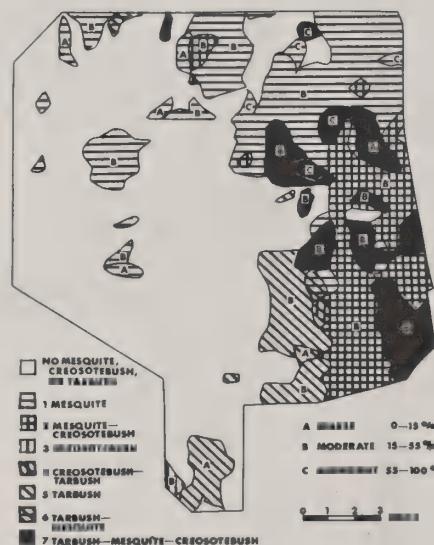
Perennial grasses, forbs, and shrubs are not only the most conspicuous element of the vegetation but also provide the basic forage resource; however, in years with favorable winter and spring moisture, many annual grasses and forbs are abundant. These annuals provide an important, but unreliable, forage source.



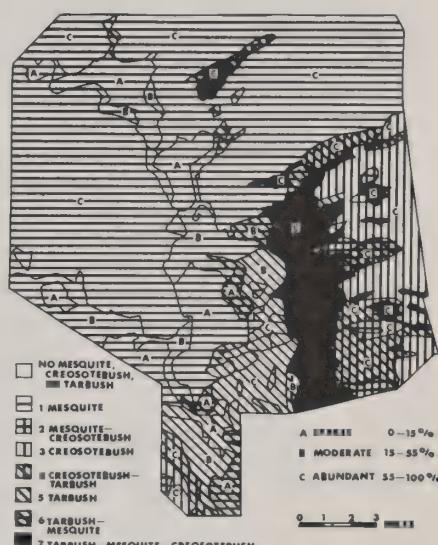
Major brush species by species composition classes in 1858 on the Jornada Experimental Range.



Major brush species by species composition classes in 1915 on the Jornada Experimental Range.



Major brush species by species composition classes in 1928 on the Jornada Experimental Range.



Major brush species by species composition classes in 1963 on the Jornada Experimental Range.

Geology and Soils

Elevations range from 4,200 feet (1,260 meters) on the plains to 8,500 feet (2,833 meters) in the mountains. The San Andres Mountains are formed from a west-dipping fault block and have moderate to steep slopes on the west and precipitous slopes on the east. Rocks in the mountains are derived from marine sediments deposited in Paleozoic time.

Materials carried in by the ancestral Rio Grande and washed from the surrounding mountains have formed the Jornada Plain, which occupies the level-to-gently-undulating floor of the intermountain basin. The basin is closed, with no external drainage, and water occasionally collects in the scattered low spots or playas. Coarser sediments are found near the foothills, and finer soil particles, the silts and clays, are found in the lowest areas. Both water and wind erosion processes are still active and microrelief changes are continuous.

Some 22 soil types have been described on the Jornada Plain. The soils have almost no humus or organic matter, and there is little change in texture between surface soil and subsoil. The lime content is high in all of the soil types. Through time, lime from the soil and from calcareous dust has been leached downward and deposited at the depth to which rainfall normally penetrates, from a few inches to several feet. This zone of lime accumulation, or caliche layer, is often so thick and dense that neither water nor roots can penetrate it.

Common Plants on the Jornada Experimental Range

Perennial Grasses:

- | | |
|---------------------|--------------------------------|
| Black grama | <i>Bouteloua eriopoda</i> |
| Mesa dropseed | <i>Sporobolus flexuosus</i> |
| Red threeawn | <i>Aristida longiseta</i> |
| Tobosa | <i>Hilaria mutica</i> |
| Burrograss | <i>Scleropogon brevifolius</i> |
| Sand dropseed | <i>Sporobolus cryptandrus</i> |
| Alkali sacaton | <i>Sporobolus airoides</i> |
| Plains bristlegrass | <i>Setaria macrostachya</i> |
| Bush muhly | <i>Muhlenbergia porteri</i> |
| Fluffgrass | <i>Erioneuron pulchellum</i> |

Annual Grasses:

- | | |
|--------------------|-------------------------------|
| Six-weeks threeawn | <i>Aristida adscensionis</i> |
| Six-weeks grama | <i>Bouteloua barbata</i> |
| Needle grama | <i>Bouteloua aristidoides</i> |
| False buffalograss | <i>Munroa squarrosa</i> |

Perennial Forbs:

- | | |
|----------------------|------------------------------|
| Desert Baileya | <i>Baileya multiradiata</i> |
| Wooly paperflower | <i>Psilostrophe tagetina</i> |
| Leatherweed croton | <i>Croton corymbulosus</i> |
| Spiny-leaved perezia | <i>Perezia nana</i> |

Annual Forbs:

- | | |
|-------------------------|--|
| Tumbling russiantistle | <i>Salsola kali</i> var. <i>tenuiflora</i> |
| Wislizenus spectaclepod | <i>Dithyrea wislizenii</i> |
| Lemonweed | <i>Pectis papposa</i> |

Shrubs and Shrublike Plants:

- | | |
|-------------------|--|
| Creosotebush | <i>Larrea tridentata</i> |
| Honey mesquite | <i>Prosopis juliflora</i> var. <i>glandulosa</i> |
| Tarbush | <i>Flourensia cernua</i> |
| Broom snakeweed | <i>Xanthocephalum sarothrae</i> |
| Fourwing saltbush | <i>Atriplex canescens</i> |
| Soaptree yucca | <i>Yucca elata</i> |
| Longleaf ephedra | <i>Ephedra trifurca</i> |
| Mountain mahogany | <i>Cercocarpus montanus</i> |
| Mescat acacia | <i>Acacia constricta</i> |
| Ocotillo | <i>Fouquieria splendens</i> |
| Wheeler sotol | <i>Dasyllirion wheeleri</i> |

Trees:

- | | |
|---------------------|-----------------------------|
| Oneseed juniper | <i>Juniperus monosperma</i> |
| Mexican pinyon pine | <i>Pinus cembroides</i> |

Brush Invasion

The increase in brush on the Jornada Plain can be documented. The land survey made in 1858 included notes on soils and vegetation. From these notes, the relative abundance of brush types in 1858 was reconstructed. Extent of brush types was also determined from vegetative surveys made on the Jornada Plain in 1915, 1928, and 1963.

In 1858, good grass cover was present on more than 90 percent of the 144,475 acres (58,492 hectares) studied. By 1963, less than 25 percent of the area had good grass cover. The following table shows the percentage of area occupied by dense (55 to 100 percent of perennial plant composition) brush cover of the major brush increasers at various dates. A large proportion of the brush increase has occurred since 1928, as shown in the following table:

Vegetation cover	1858	1915	1928	1963
— — — — Percent — — — —				
Brush-free	58	25	23	0
Dense honey mesquite	4	22	21	46
Dense creosotebush	0	1	1	9
Dense tarbush	0	.5	1	3

Mesquite is the primary invader on sandy soils. Tarbush has increased on the heavier soils, and creosotebush has taken over shallow and gravelly soils. Collectively, the spread of brush has been ubiquitous and rapid. As a result, range-carrying capacities have been drastically lowered. Periodic droughts, selective grazing of grasses by livestock, and brush seed dispersal by man, livestock, and rodents have all contributed to the spread of the shrubs. Permanent livestock exclosures erected in the 1930's have been taken over by brush, showing that brush will invade grasslands even in the absence of grazing. Once established, brush effectively monopolizes soil moisture, and reestablishment of grasses cannot occur unless the brush plants are killed.

Animals Found on the Jornada Experimental Range

Large herbivores:

- | | |
|----------------------|------------------------------|
| Antelope | <i>Antilocapra americana</i> |
| Mule deer | <i>Odocoileus hemionus</i> |
| Desert bighorn sheep | <i>Ovis canadensis</i> |
| Gemsbok | <i>Oryx gazella</i> |

Carnivorous mammals:

- | | |
|---------------|----------------------------------|
| Coyote | <i>Canis latrans</i> |
| Gray fox | <i>Urocyon cinereoargentatus</i> |
| Desert fox | <i>Vulpes macrotis</i> |
| Badger | <i>Taxidea taxus</i> |
| Bobcat | <i>Lynx rufus</i> |
| Striped skunk | <i>Mephitis mephitis</i> |

Small mammals:

- | | |
|----------------------------|----------------------------------|
| Ord's kangaroo rat | <i>Dipodomys ordii</i> |
| Merriam's kangaroo rat | <i>Dipodomys merriami</i> |
| Banner-tailed kangaroo rat | <i>Dipodomys spectabilis</i> |
| White-throated wood rat | <i>Neotoma albigenula</i> |
| Southern plains wood rat | <i>Neotoma micropus</i> |
| Silky pocket mouse | <i>Perognathus flavus</i> |
| Penicillate pocket mouse | <i>Perognathus penicillatus</i> |
| Spotted ground Squirrel | <i>Citellus spilosoma</i> |
| Grasshopper mouse | <i>Onychomys leucogaster</i> |
| White-footed mouse | <i>Peromyscus maniculatus</i> |
| Cotton rat | <i>Sigmodon hispidus</i> |
| Harvest mouse | <i>Reithrodontomys megalotis</i> |
| Desert cottontail | <i>Sylvilagus auduboni</i> |
| Blacktailed jackrabbit | <i>Lepus californicus</i> |
| Big brown bat | <i>Eptesicus fuscus</i> |
| Pallid bat | <i>Anthrozous pallidus</i> |

Birds:

- | | |
|-----------------|-------------------------------|
| Roadrunner | <i>Geococcyx californicus</i> |
| Marsh hawk | <i>Circus cyaneus</i> |
| Redtailed hawk | <i>Buteo jamaicensis</i> |
| Swainson's hawk | <i>Buteo swainsoni</i> |
| Golden eagle | <i>Aquila chrysaetos</i> |
| Shorteared owl | <i>Asio flammeus</i> |
| Burrowing owl | <i>Speotyto curvirostra</i> |
| Mourning dove | <i>Zenaidura macroura</i> |
| Gambel quail | <i>Lophortyx gambelli</i> |
| Scaled quail | <i>Callipepla squamata</i> |

Animals Found on the Jornada Experimental Range —Continued

Reptiles and amphibians:

Prairie rattlesnake	<i>Crotalus viridis</i>
Diamondback rattlesnake	<i>Crotalus atrox</i>
Texas horned lizard	<i>Phrynosoma cornutum</i>
Tiger salamander	<i>Ambystoma tigrinum</i>

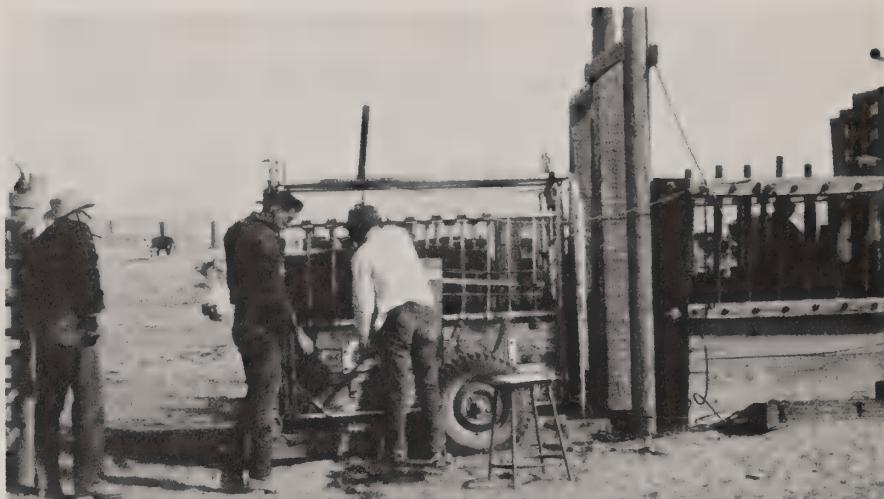
Wildlife

The Jornada Experimental Range lies within the Chihuahuan biotic province. The fauna is representative of that found in the upper Sonoran and Transition Life Zones throughout the Southwest.

A small band of antelope (40 to 60 individuals) inhabit the Jornada Plain. The antelope population has been fairly stable for many years. Mule deer inhabit the foothills and mountains and have, at times, been quite numerous. A number of gemsbok, introduced from Africa, have taken up residence on the plain and in the lower foothills.

Rabbit populations are cyclic and at times of population highs can be very numerous. Cottontails and jackrabbits combined have been censused at densities up to 1,700 animals per section (656/km²). Rodent populations are also cyclic, and one species or another is usually present in abundance. Rodents are most numerous in the mesquite dune areas and least abundant in the tobosa and burrograss areas. Both rodents and rabbits can consume large quantities of forage when they are abundant.

Bird populations are normally quite low, although quail and doves are numerous in some years. The ubiquitous coyote is the most abundant of the carnivorous animals.



Recording weight changes at headquarters.

Management

Grazing management follows a "Best Pasture System," which, as the name implies, means that if animals are moved they go to the pasture with the best forage at that time. Under this system, cattle normally use tobosa and burrograss areas during the growing season; black grama range in winter; and mesquite sanddunes in late winter and spring, provided there is enough moisture for the growth of annuals. Flexibility in both time of grazing and number of animals is essential if arid ranges are to be maintained in good condition. Water development and salt placement are used to obtain uniform grazing within pastures.

An important part of Jornada management is an action program to reclaim grassland lost to brush invasion. Many methods of brush control have been tested. Application of dry herbicides from horseback and aerial spraying have proved to be both relatively cheap and effective in controlling mesquite. Herbicides have been applied to about 26,000 acres since 1958. These efforts have resulted in increased grass production, but have only suppressed, not eradicated the brush. Seeding deteriorated range with native and introduced forages is being studied but has not been carried out on large acreages.

Management includes improvement of herd quality. For several years, purebred and crosses of Herefords, Santa Gertrudis, and Brangus have been evaluated as breeding cows. Santa Gertrudis, Brangus, and crossbred cows have consistently produced larger calves at weaning than have Herefords. Purebred Brangus cows are no longer used but the herd has an increasing proportion of Santa Gertrudis and crossbred cows (only first-generation crosses are retained for breeding cows).

Past Research

Rainfall, stocking, and vegetation have been continuously recorded since 1914. Many significant contributions have been made on the ecology and biology of native plants and animals. Much past research has been directed at problems associated with the livestock industry on rangeland. Some of the contributions toward better management of arid rangelands are as follows:

1. Developing proper utilization standards for black grama and tobosa.
2. Developing principles of seasonal use of black grama and tobosa.
3. Obtaining better livestock distribution by water development and salting away from water.
4. Improving livestock through the introduction of higher quality breeding animals.
5. Establishing principles of flexible herd management to cope with a fluctuating forage crop and droughts.
6. Enhancing the ecology of arid rangelands.
7. Improving methods for controlling brush.
8. Developing methods and equipment for revegetation of depleted rangelands.
9. Determining effective grazing management for sustained yield and protection of the range resource.

All of the past research is invaluable in providing a data base for the development of management strategies and in permitting the insight necessary for the development of present and future research plans.

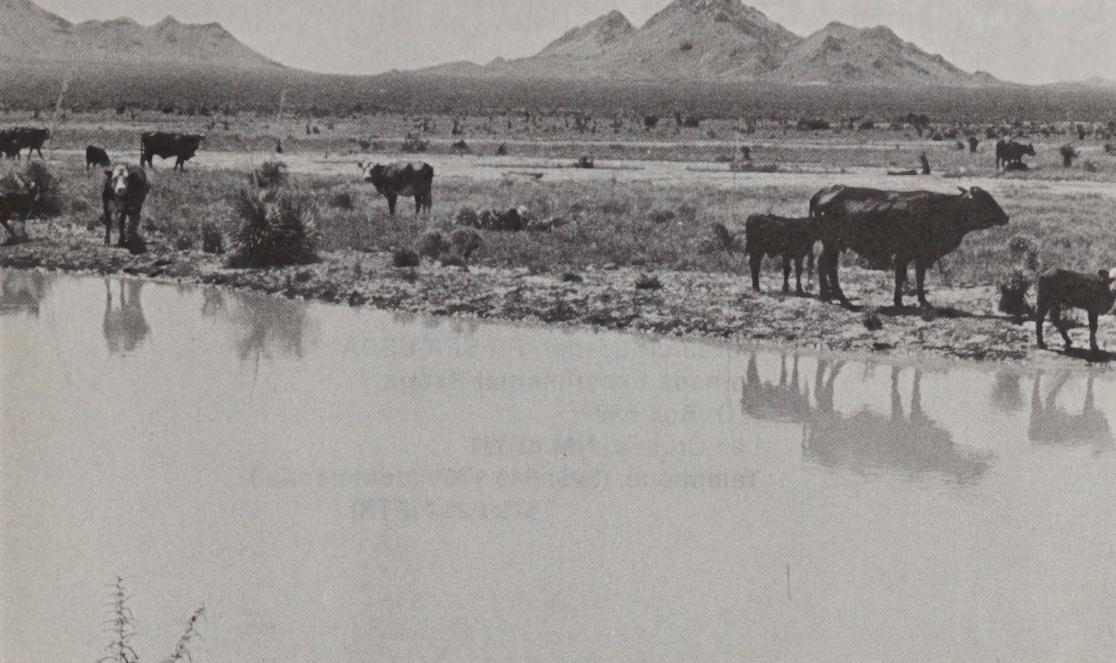


Clipping black grama.

Present Research Activities

Both basic and applied research on the Jornada Experimental Range are aimed toward increasing the productivity of rangelands while maintaining or improving the range resource. In the following outline, three specific objectives are given, and the items or areas currently being investigated are listed under each objective.

- I. To define the structure and function of range ecosystems, and to determine the morphological, physiological, and abiotic factors that govern establishment, growth, reproduction and persistence of range plants.
 - A. Measurement of plant productivity on different range sites and on brush control treatments.
 - B. Phenological development of forage grasses and forbs.
 - C. Photosynthetic efficiency of forage species.
 - D. Plant-water relations.
- II. To develop range improvement practices for revegetating disturbed and deteriorated rangelands by stabilizing soils, improving water management, and controlling pests to increase productivity of range ecosystems.
 - A. Infiltration, runoff, and sedimentation of soil-vegetation complexes.
 - B. Enhancement of infiltration on fragile, denuded rangeland sites.
 - C. Methods of brush control.
 - D. Range seeding.
- III. To develop improved grazing strategies to convert range forage to animal products consistent with conservation and multiple use of range ecosystems.
 - A. Botanical and chemical composition of cattle diets.
 - B. Habits of grazing livestock
 - C. Cattle herd improvement.
 - D. Supplemental feeding.



Science and Education Administration

On January 24, 1978, four USDA agencies—Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), and the National Agricultural Library (NAL)—merged to become a new organization, the Science and Education Administration (SEA), U.S. Department of Agriculture.

SEA is the largest agency of its kind in the world, and the Federal Research (FR) staff is its major research arm. The primary mission of SEA-FR is to help in meeting the food and fiber needs of our nation and of the world by providing an aggressive research program with maximum responsiveness to agricultural problems.

SEA-FR works in close cooperation with State experiment stations, State departments of agriculture, other government agencies, public organizations, farmers, ranchers, and industry.

The Agency's research is conducted at more than 150 laboratories, field stations, and work sites in 46 States, the District of Columbia, Puerto Rico, the Virgin Islands, and nine foreign countries. In the United States, SEA-FR facilities are located in four locally administered geographic regions. Twelve Western States comprise the Western Region, which is headquartered at Berkeley, Calif.

The Jornada Experimental Range has the largest acreage of any SEA field station. It is located in the Arizona-New Mexico area (one of six similar subunits dividing the Western Region), which is headquartered at Tucson.

Visitors and Information

Visitors are most welcome at the Jornada Experimental Range. For information or tours, contact:

**Research Leader, FR-SEA-USDA
Jornada Experimental Range
P.O. Box 698
Las Cruces, NM 88001
Telephone: (505) 646-1709 (commercial)
572-0254 (FTS)**



JORNADA EXPERIMENTAL RANGE
October 1912